MEMOIRS

OF THE

IMPERIAL COLLEGE OF TROPICAL AGRICULTURE, TRINIDAD.

MYCOLOGICAL SERIES

IMPERIAL BUREAU OF MYCOLOGY

Via colendi haud facilis.

No. 2.

CONTROL OF THE AMERICAN LEAF DISEASE (*Omphalia flavida*) ON ARABIAN COFFEE IN TRINIDAD.

BY

H. R. BRITON-JONES, D.Sc., Ph.D. D.I.C., A.R.C.S.,
Mycologist and Bacteriologist, Imperial College of Tropical Agriculture.

AUGUST,
1930.

CONTROL OF THE AMERICAN LEAF DISEASE (*Omphalia flavida*) ON ARABIAN COFFEE IN TRINIDAD.

Digitized by the Internet Archive
in 2025

https://archive.org/details/memoirsofimperia0000vari

CONTROL OF THE AMERICAN LEAF DISEASE (*Omphalia flavida*) ON ARABIAN COFFEE IN TRINIDAD.

BY

H. R. BRITON-JONES, D.Sc., Ph.D., D.I.C., A.R.C.S.
Mycologist and Bacteriologist, Imperial College of Tropical Agriculture.

Introduction.

ACCORDING to Nowell[1] the American Leaf Disease is reported from all the coffee-growing countries of Central and South America, and in the Antilles from Jamaica, Porto Rico, and Dominica. The author records having seen the disease twice in Trinidad. In recent years, however, the disease has become more widely spread in the latter island attracting a great deal of attention on several coffee-growing estates situated in the Northern Range. In certain localities of the Caura and Lopinot valleys it causes considerable losses in Arabian Coffee. At lower elevations it occurs sporadically. It has also been observed to a serious extent on Robusta Coffee but this latter variety is not grown to any extent in that part of the island. Recently it was announced[2] that the disease is spreading in an alarming manner in Nicaragua.

In regard to the means of controlling the disease Nowell[1] states as follows:—"The most obvious way of reducing the prevalence of the disease is by increasing the access of sun and air to the trees, but as in the similar case of cacao pod-rot it may not be possible to carry out this measure far without producing equal injury from exposure. Picking off the affected leaves has been found to exercise some control but can only be profitable where labour is cheap. Spraying with Bordeaux Mixture is quite effective against the spread of the fungus, provided that the fungicide can be made to adhere for a considerable time to the leaves. Spraying is likely to have its greatest value when adopted to preserve the freedom of young plantations from the disease."

Factors affecting the Disease.

The writer's observations on the distribution of this disease have led him to the same conclusion as that drawn by Nowell who states that "the presence and dissemination of the disease are closely dependent on humid conditions and in these islands (*British West Indies*) it accordingly occurs most abundantly in the wetter hill districts." It is perhaps desirable, however, to stress the importance of high atmospheric humidity rather than high rainfall since severe cases of infection have been observed in localities with a considerably lower rainfall than others where the coffee is quite free from the disease. In the Manacal district of the Caura valley, for example, there are stretches of coffee cultivation which are entirely free from the disease and these alternate with areas in which the disease is present to a serious extent on almost every coffee bush. The change from diseased to non-diseased areas is quite sudden and is generally near a bend in the mule track which leads up the valley. This sectional distribution of the disease is probably due to the fact that heavy blankets of mist envelop the coffee bushes for prolonged periods, particularly at certain times of the year, in the pockets which are not subjected to the drying effect of the breeze blowing up the valley.

Normally the disease spreads slowly having been estimated in Porto Rico[1] to be at the rate of 200 yards a year. Observations in Trinidad do not indicate anything more than that, in a general way, this fungus disease spreads very much more slowly than many other leaf-infecting fungi. In some cases three or four bushes may

be badly affected for some years before the disease spreads to the other neighbouring bushes which are but a few feet away. On the other hand, the appearance of the disease on individual bushes as much as a mile or more from the nearest source of infection suggests that the tiny fructifications of the fungus can be carried by various agents such as birds, insects, human beings, pack mules, &c., for some distance. Furthermore, even after the first appearance of the disease on a coffee bush it takes at least two years before it becomes so seriously affected as to cause much defoliation. Eventually, however, the disease causes an almost complete loss of crop.

Local Conditions.

The measures of control previously recommended appear to be inapplicable to conditions prevailing in the coffee-growing areas in Trinidad. In recommending the increasing of the access of sun and air Nowell quite rightly issues a word of warning by pointing out the danger of producing equal injury from exposure. There are also the following reasons why this cannot be done. Firstly, coffee is generally interplanted and grown in the shade of established cacao plantations. Markedly and permanently to reduce the shade would, therefore, force the choice between the coffee and cacao. This is an issue which often arises in problems dealing with mixed cropping. As will be explained later, temporary reduction of shade can be affected to the advantage of both coffee and cacao apart from this disease. When Black-Pod of cacao and the American Leaf Disease of coffee are considered, however, the advantages are very much enhanced. Secondly, to increase the access of air currents into these areas would mean clearing some of the forest reserve above the cultivations. This is a matter which would present various difficulties and it is doubtful whether in its wider aspect it would not result in more harm than good. The three lines of work along which the problem of satisfactory control was studied were (i) Spraying with a view to killing fructifications already on the leaves thereby reducing the amount of infection of the leaves subsequently produced; (ii) Completely defoliating the affected bushes so as not to affect the cropping to any serious extent and at the same time free them from the disease and (iii) Manuring, pruning, liming, and cultivation to induce vigorous new growth.

As a general rule, although there are exceptions, young bushes are not so badly diseased as older cropping bushes. This may be partly due to the fact that they have not been infected for sufficiently long a period. Secondly, young bushes have fewer branches and, therefore, the humidity of the atmosphere within the crop is not so high as in the denser growth of the older bushes. Thirdly, young bushes grow more vigorously producing longer though fewer branches than older bushes. In other words, they grow away from the older infected leaves faster than in the older bushes. This is an important factor since it is on such young growth that the crop is produced in the following season. Manuring, cultivation and pruning were, therefore, of great importance not only as factors conducive to the control of this disease but also towards increased crop production. Drainage in some localities would also be a factor which would obviously decrease the atmospheric humidity and improve the growth of the bushes. Indeed, it might be said both in regard to coffee bushes affected by this disease, as well as non-diseased bushes, that the factors to aim at in coffee production are those which stimulate the plant to make new growth. If this can be accomplished then a good crop is assured provided, of course, that weather conditions are favourable to good setting. These points are further discussed below.

Spraying for Defoliation.

In the first instance it was thought that the easiest, and least harmful way of completely defoliating diseased coffee bushes would be by means of a fungicidal spray of the type which is used in temperate climates as a winter wash. Several such sprays were tested out on young coffee bushes using them at different strengths in the hope of obtaining a bracket for further tests. The sprays tested were washing soda and soft soap solution, and different brands of tar distillate washes. The maximum strength used for each was ten per cent. and the cost of this was considered to be well over the economic limit for application on a large scale. The tests were carried out on potted plants on the floor of a large laboratory so as to avoid any washing off by rain. The washing soda and soft soap solution was also tested under field conditions at a strength of ten per cent. In no case did these sprays cause defoliation of the coffee plants. The only damage caused to the leaves was local and then only when tiny pools of the tar distillate washes at ten per cent. strength were held in the folds which sometimes occur on some of the leaves.

Field Experiments.

Experiment I.

A series of plots comprising 100 bushes each in diseased areas were marked out on an estate with a view to ascertaining the influence of pruning, spraying, cultivation, manuring and liming, on the incidence of this disease. The method of pruning adopted throughout the experiment was the routine method generally used in Trinidad on most of the coffee-growing estates, and for this reason the whole series of plots gave negative results so far as the success of any of the treatments as a means of control was concerned. The trials, however, were most useful since the experience gained in applying the various treatments suggested a second experiment on a smaller scale which gave encouraging results. The normal method of pruning consists of thinning out the branches

and cutting out the dead ones as well as those which grow inwards and across the bush. This meant that many leaves affected by the disease were left on the bushes and it was feared these would act as sources of infection to the new growth. Observations carried out some months later showed that this is what did happen.

The spray used in the sprayed plots was a two per cent. Burgundy Mixture. This fungicide was used in preference to others because (i) it adheres better than either Bordeaux or Lime Sulphur to the leaves (ii) it is an effective fungicide and is much more reliable than Lime Sulphur particularly under shady conditions (iii) it is much more easily prepared than either Bordeaux Mixture or Lime Sulphur and (iv) it has the added advantages over Bordeaux Mixture in that washing soda is more easily obtainable than the higher grade of quicklime necessary for the preparation of Bordeaux and it does not clog the spraying nozzles.

The experience of spraying under the conditions prevailing in the upper reaches of the valleys in the Northern Range in Trinidad has convinced the writer of its impracticability as a means of control even if the spray had proved satisfactory against the disease. When the purchase price of materials, and the cost and time of transporting all utensils such as spraying machines, barrels, stock solutions, and water, up steep hillsides is taken into consideration, spraying is definitely ruled out as an economic means of control. Furthermore, the labour on these estates moves from one district to another from time to time so that each time spraying is to be done the labour gang has to be instructed in the use of the spraying machines. Their standard of intelligence is also very low since it takes much time and patience to make them realise that it is better to spray with their backs to the breeze and that mud and vegetable matter clog the spray nozzles. Furthermore, in these particular trials, observations carried out some months later showed that spraying coffee bushes with two per cent. Burgundy Mixture does not effectively reduce this disease. There was no observable difference between the number of fresh infections on the sprayed and unsprayed bushes.

Experiment II.

At the same time as the above experiment was carried out a few bushes were subjected in different degrees to more drastic methods of pruning. In one case the branches and leaves were almost entirely removed leaving the primary branches a few inches in length only. In others, branches were thinned out and treated very much as they were in Experiment I except that the branches remaining were themselves cut back to varying lengths with about 18 inches as the maximum length left on the bush. Furthermore, all leaves both healthy and diseased were removed and left lying on the ground under the bushes. When examined several months later both sets of bushes had produced new growth, the leaves on which were free from the disease. It was considered, however, that the cutting back of primaries to a length of a few inches only, although effective against the disease, was too drastic and would result in too much loss of yield due to the time factor required to produce sufficient new growth. The second method, however, had produced many healthy branches and was considered to be the treatment which was required as a means of disease control except that it should, in application, be carried out on larger sections so as effectively to avoid reinfection from outside the treated areas.

Experiment III.

The results of Experiments I and II led the writer to conclude that the best means of controlling this disease was by means of a heavy pruning though not so drastic as to cause a definite set-back, coupled with the complete defoliation of the few leaves remaining, as well as manuring, cultivation, &c. to induce the subsequent production of vigorous new growth. To put this to the test a block of 400 badly diseased coffee bushes was taken and pruned as follows:—

The branches growing inwards and across the crowns were cut out, and others thinned out by cutting almost to the base whilst those remaining were cut back to different lengths depending on the position of the suitable node bearing living buds. Furthermore, all leaves, large and small, diseased and healthy, were removed. All self-sown seedlings growing under the bushes whether healthy or diseased were uprooted by hoeing. The cuttings, leaves and seedlings were then collected into heaps to wilt and rot. No special precaution was taken to ensure that all leaves were collected into heaps nor were the heaps burned. Previous experience had led to the conclusion that this care was unnecessary and to collect all leaves and cuttings and burn the heaps would mean further labour and expense and the loss of valuable humus to the soil. The above treatment was carried out in the first week in January, 1930, and immediately afterwards the 400 bushes were also given a dressing of nitrate of soda at the rate of two hundredweights per acre. In the following June after the rainy season had commenced the bushes were given a second dressing of nitrate of soda at the same rate so that in all they received the manure at a rate of four hundredweights per acre. Observations carried out at the end of May just before the second dressing was applied showed that the bushes had made excellent growth and that they had not set a crop in the month of May which is the normal month for blossoming in Trinidad. Furthermore, they were completely free from the disease which had affected them seriously prior to the treatment. Previous observations on the disease show that a block of this size (500 bushes cover an acre) will remain comparatively free from the disease for several years since the disease spreads very slowly. The larger the area treated, of course, the better the result.

Effect of Treatment on Cropping.

The 400 bushes in Experiment III had been badly affected by the disease for some years before the treatment was given and consequently were yielding crops very much below the average for non-diseased bushes. Furthermore, the fact that they had not been pruned resulted in much bare wood and dead wood and the extension shoots were spindly and bearing small sized leaves. In addition to the fact that they were yielding small crops can be added the poorness in quality of the crop which was produced. The planter's estimate was 75 per cent. loss. The hard pruning coupled with the complete defoliation which is essential for the control of the disease has resulted in almost complete loss of crop for the present season. This is due to the fact that the bushes were bearing such a tangled mass of branches that most of the previous year's wood had to be removed in reshaping the scaffolding for future growth. On the other hand they have already (May, 1930) made good growth which is entirely free from the disease and in a year from now will be in a condition to yield a very heavy crop. The results are so convincing that the writer, and the planters on whose estates these trials have been carried out agree with him, considers that it would be advisable to adopt this treatment for all badly diseased bushes. Furthermore, that a more drastic form of pruning should be applied to the diseased and healthy bushes once every two years. The normal flowering time for coffee in Trinidad is in the month of May and the crop is picked in November and early December. If the treatment of diseased bushes and the pruning (without defoliation) of healthy bushes is carried out immediately after picking (*i.e.*, before Christmas) the bushes will have five months period of growth before flowering time and more particularly will they benefit from the rain which falls during the months of December and January before the dry season sets in. If the treatment is delayed too long after picking it will mean a reduction in the amount of growth produced before the date of blossoming in the following May and, therefore, a reduction of the crop in the subsequent year.

Principles of Berry Production.

As already stated the chief aim of every coffee planter who desires heavy crops should be towards those factors which tend to stimulate the bushes into the production of new growth. New growth and cropping go hand in hand in the case of coffee as with some other crops such as black currants. In this respect the principles underlying crop production are far simpler to apply than is the case with such crops as mangoes, apples, pears and to a lesser degree citrus as a genus. Crops such as coffee, apples and pears, however, have one point in common at a certain period in their growth, namely, the tendency towards what is commonly known as "biennial bearing." "Physiological cycle" is perhaps a better term than either "biennial" or "seasonal" since it embraces both and indicates cause rather than effect. In the past this was considered to be a genetic factor and there is no doubt that the genetic constitution of a plant has something to do with it since external physiological factors influence different varieties in different degrees. Excluding possible exceptions the tendency with a large number of fruit-producing crops, including coffee, is to produce a small crop in the year following a heavy crop. This is due to the fact that the production of a heavy crop in response to soil and weather conditions exhausts the plant's reserve of food material to such an extent that it requires a season during which to recover. This introduces the wide subject of the principles of fruit production and further explanation would largely depend on the particular species and variety of fruit in question. In regard to coffee berry production, however, the main axiom for the planter is to "cut back and drive out." This cutting back and driving out refers to the branches on which, of course, the leaves, blossoms and berries are borne. There are several methods of pruning coffee bushes but the principle underlying all is included in the phrase "cutting back and driving out."

The coffee planter's attention is focussed on to the "biennial bearing" phase at one period in the plant's life history since it becomes more apparent in bushes which are generally considered to be of cropping age. Viewed from a fundamental physiological point of view rather than from cropping yields the same factors are at work in cropping bushes of all ages. In young bushes they are less apparent because they produce less crop and are generally in less exhausted soil, so that they are able also to produce much new growth resulting in an increased crop from year to year up to a certain age when the definite "biennial bearing" phase becomes apparent in the yield. In other words the bigger the crop produced the less subsequent new growth will be proportionally produced. This will be made clear to the planter if we consider young bushes denuded of their blossom and not allowed to set and mature the berries. Such bushes would produce much more vegetative growth in the following season than other comparable bushes which have carried a normal crop. Cropping bushes showing in yield figures that they are in the "biennial bearing" phase will, if left unattended, reach a stage when the amount of new growth formed gradually diminishes and this will be reflected in the reduction in berry production and incidentally a diminution in the size and quality of the berries.

In the case of temperate fruits the tendency, particularly where good dessert fruit is desired, is to apply a system of pruning which controls the metabolic processes of the fruit trees in such a manner that they, the vagaries of climate excluded, produce an even crop year after year. An important factor in favour of this system is that in the bumper years prices are low but if moderately good crops of good quality are

produced in normally lean years the prices are good and it is during such seasons that the expert fruit grower makes his profits. A somewhat similar argument for various reasons, can of course, be advanced in favour of the annual pruning of coffee bushes as is actually being done in several coffee-growing countries at the present time. On the other hand such a system of pruning requires expert knowledge on the part of the planter and it is considered that for the present, particularly in view of the presence of the American Leaf Disease, the biennial pruning method will markedly improve the yields both on diseased and non-diseased coffee bushes in Trinidad. Furthermore, it does not require expert knowledge and tends but slightly to modify the natural tendency towards "biennial bearing" rather than change it. Although the pruning method suggested is "biennial" in character it means a definite increase of crop during the normal "biennial bearing" phase of the crop and extends this for a longer period whereas at the present time the "senile" phase is arrived at in topped bushes much sooner with the inevitable cropless period following the cutting out of the old and useless bushes. The latter remarks apply only to topped bushes which are the only possible ones under Trinidad conditions, namely, under cacao.

The "biennial bearing" phase of topped coffee is probably more marked in some countries than in others. Conditions in the Northern Range of Trinidad are normally favourable to rapid growth in the wet season and heavy setting in the dry season. Such conditions tend towards "biennial bearing" of bushes of the so-called cropping age. Bad weather at the blossoming period can, of course, effectively reduce the yield of bushes which are in a good condition for carrying a heavy crop. When, however, conditions of weather and soil have resulted in a heavy crop such bushes are so exhausted of food reserves that even with adequate pruning and manuring coupled with favourable weather conditions they will proportionally give a reduced yield in the following season. If no pruning and manuring is done this drop in yield will be very much more marked, and in both cases the age of the bush comes in as a factor for the reasons previously given. In other countries where soil and weather conditions are different annual pruning might give better results. Furthermore, it is possible that the system of triennial pruning coupled with the triple or multiple stemmed bushes would give results which would be nearer the desired optimum. Indeed, the writer wishes to make it clear that the system suggested above for Trinidad is not necessarily the best possible one, but it is, nevertheless, a step in the right direction since it is a means of controlling American Leaf Disease and a means of increasing the average yield of bushes which are diseased and non-diseased. There is a great deal more work to be done on the pruning and other treatment of coffee in Trinidad but this is outside the scope of the present investigation. To improve on present methods is an easy matter but to arrive at the best is a matter of the greatest difficulty and is to be arrived at after several years of experimentation, and in the end it remains for the planter to interpret and apply the principles of pruning which will best suit the particular conditions of soil and climate under which the coffee is being grown. A pruning scheme can and should be worked out which would be applicable in a general sense to Trinidad, nevertheless, as already indicated, the knowledge and ingenuity of the individual planter will still have scope in its application by the adoption of slight modifications to meet local conditions.

The effect of the above cultural treatment of coffee bushes on the size and quality of the beans is a matter of importance. No data are available on this point up to the present time, but tests will be made later in regard to the size and quality of beans from treated and untreated bushes on a financial basis. It is common knowledge, however, that coffee as well as several other woody fruit producing trees, if left unpruned, will produce short spindly extension shoots on which are formed small leaves and small sized fruit. For the same reason, young plants yield larger sized fruit than older ones. The main object of pruning and manuring is to induce the production of strong young growth, bearing large leaves and large berries. It is no wild speculation, therefore, to forecast an improvement in size and quality of the beans produced by the bushes treated as described above.

Other Varieties.

The suggestion has been made that the best means of dealing with the American Leaf Disease would be the growing of a variety highly resistant or immune to the disease. This is always a possibility as a means of avoiding disease but complete immunity from all diseases and pests is almost unknown amongst cultivated plants. The variety Robusta has been observed to be severely attacked by this disease under conditions similar to those under which Arabica is badly affected. Furthermore, this variety would not be so successful as Arabica under the shade of cacao trees. Excelsa coffee and Liberian are known to be attacked in Trinidad by another potentially serious disease known as the Sclerotium disease and caused by the fungus *Sclerotium coffeicolum*. A good highly resistant or immune variety is still possible, of course, but in the meantime it is well to bear in mind (i) that on individual estates large areas are already planted up with Arabica and (ii) that the new variety will take five years before it bears an appreciable crop.

Temporary Reduction of Shade.

The diseased coffee is grown in the shade of cacao and permanently to reduce this shade would mean serious interference with the cacao. On the other hand, the blossoming period of

coffee is in May which is normally a dry month. In some years, however, heavy falls of rain occur which under the shady conditions seriously reduce the amount of blossom setting in the coffee. Cacao also responds in increased cropping as the result of pruning by thinning out branches and the best time to do this is immediately the crop is over, namely, in February, March and April. Such thinning of cacao growing above the coffee would mean very much less shade and, therefore, heavier setting of the coffee in May. It would also reduce the American Leaf Disease of coffee, and increase the yield of cacao as well as by reducing the losses caused by Black Pod.

Future Work.

It is not possible to go fully into the question of cost of treatment at the present time but it is sufficient evidence in favour of the treatment recommended to say that the planters on whose estates it has been carried out are adopting it. Furthermore, the writer feels that to control American Leaf Disease of coffee in Trinidad is only a beginning. This must be introduced as a factor into a general system of coffee cultivation with a view to the production of a higher grade of coffee which is obviously desirable if the product is to be exported. The aim should be to establish the economic mean between amount and quality of coffee produced, and it is hoped to carry out further work on these lines in the future. Furthermore, there is also much room for improvement in the preparation after picking.

Acknowledgments.

I am fully conscious that this preliminary investigation could not have been carried out without the closest co-operation of Mr. H. Rapsey and Mr. R. de Souza on whose estates the work was done. I wish, therefore, to express my gratitude to both these planters.

Bibliography.

1. Nowell, W.—Diseases of Crop Plants in the Lesser Antilles. *West India Committee*, London.

2. *West India Circular*, 20th March, 1930.

TRINIDAD :
Printed by the Government Printer,
Government Printing Office,
Port-of-Spain.
1930.